Menlo Park Notebook #80 [N-79-06-12]

This notebook covers the period June 1879-September 1880. The entries are by Edison, Charles Batchelor, John Kruesi, and Francis Upton. Most of the material relates to electric light or telephone experiments. The electric light material includes notes, calculations, and drawings of generators; drawings of filaments, bulbs, and sockets; and notes on equipping the Menlo Park lamp factory. The telephone material includes notes and drawings relating to telephones, central exchange systems, and chalk experiments. There are also notes on ore separation and notes and drawings of the electric railroad. The book contains 282 numbered pages.

Blank pages not filmed: 60-63, 94-95, 114-117, 134-135, 188-189, 198-199, 206-243, 246-247, 250-255, 258-261, 266-269, 272-273, 276-279.

Missing page numbers: 165-166.

No 80

8 p HP.

gas 70¢ per M

500 burn 5 ft 2500 ft per hour

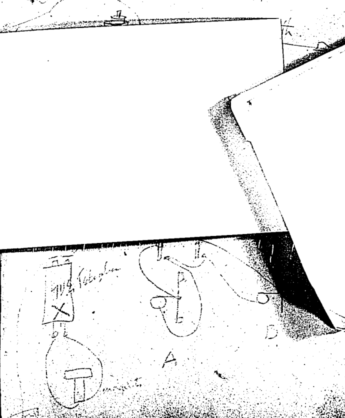
= $1.75.

50
140
35
175

8 per. H.P. 8/500
62½

Experiments on Chemical
Telephone June 12 1879,
Tae

Connections
Transmitting end.


Line
A
D
Telephone
magnet

No 80

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

, 1896.

8 p H.P.

gas 70c per M

500 burn 5 ft. 2500 ft per hour

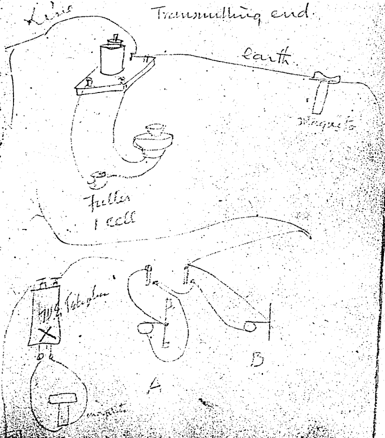
= $1.75   70/140

Experiments on Chemical Telephone June 12 1879.

TAE

Connections

Transmitting end.


Line
earth
Magneto
Fuller
1 cell
Telephone
magneto
A
B

June 12 1879 GAE

When A is in only & X is out it is exceedingly loud, when X is in it reduces it to $\frac{1}{4}$ of the volume —

When both A & B are in the cutting out of X does not materially alter the volume of sound —

I have just found a ring of large dimensions which is that sometimes when B is cut in con[illegible] sound can be heard on A at other times the cutting in [illegible] no difference, This phenomenon must be due to polarization,

---

June 12 1879 TAE

I find that with 2 chalks
the current that will
polarize one will not
always sufficiently
polarize the other hence
one chalk will be loud
& the other low, if the
battery is increased so
as to overpolarize then
the chalks may have
the pressure increased
on one & decreased on
other & this will
bring them OK so
that ~~[illegible]~~ when
one is taken out of ckt
the other will go low
owing to increase in

June 12 1879 TAE

strength of polarizing Current ~~been~~ when this is very low the insertion of the other chalk makes it loud again as it weakens the polarization current, on the other hand when one is out & the other is over polarized & low increasing the ~~[illegible]~~ pressure on the spring so that it will do as before & loudness will be nearly restored

June 12 1879 TAE

Just tried experiment of putting induction Coil in line ⑩ its primary coil of $\frac{40}{100}$ of an ohm in line & putting the chalk in a local formed of the secondary of 600 ohms it worked quite loud - I inserted the other chalk right in the line & it didn't make any difference but putting in the Induction Coil &c

June 12 1879 TAE

regular telephone X lowered it greatly & now by putting Carbon Rheometer in line with 4 cell Carbon battery placing primary of induction in ~~[illegible]~~ line & putting chalk in secondary I find that you cant scarcely hear it with 100 ohms in circuit with 4 small Carbon cells in line with 12 ohms it is fair

June 12 1879 TAE

We now use 1 cell carbon in line & shunt the ——, transmitter around it to see effect. it works loud on short ckt but 12 ohm inserted makes it low —

We now wind 4 layers of 23 wire on the outside of the induction coil forming a tertiary coil in the circuit of this we put the chalk & a polarizing battery 1 Daniell cell & find that it comes strong & loud in fact as loud as the old way when both induction coils in also

June 12 1879 TAE

that 12500 ohms may be inserted in the line & it is still readable several feet away = I then wound 6 layers of No 3 wire on a ~~[illegible]~~ Bergmann Coil for a talking & find it as loud, this extra Resistance over that which would be given by a 23 wire prevents the Chalk ckt shortcircuiting the induction from the coil when talking — The greater the resistance that can be put in this talking & have it work

June 12 1879 TAE

loud the better it will be when transmitting for the other way —

By this means we make each chalk receiver entirely independent of Everything else & have a perfectly Constant polarization of the Chalk we can use a Chloride of Silver battery to polarize the Chalk & this will [illegible] last 2 years

June 12 1879 TAE

We propose to do away with the switch & ring the bell through the coil by a very little multiple battery =

News Button

Carb Barium 1st Class

"

" Gypsum -

Chalk Hg & Sulp Magnesia "

but not proven -

— Saturated NaO-4 1/2 chalk 1/4 G.

Slaked lime. June 12 1879 TAE
Too rough · uneven —
ground platina — N.G.

Common Salt — good 1st class
Hg & $CaCO_3$ —

Phenomenon — We find that it wants a very slight Current to polarize the salt button of Battery is too strong it is low & irregular. scarcely readable while if we shunt polarizing cell down to 1 ohm we get it loud & clear — take off shunt & its low & very irregular.

June 12 1879 TAE 2

It is probable that Every solution will require a different polarizing Current Chalk seems to require 3/4 or 1/2 Daniel Salt $\frac{1}{20}$ of a Daniel roughly speaking -

---

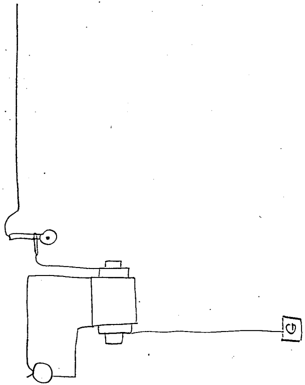
Common salt, Best

Better than ord chalk; excellent dont effervesce - ~~[illegible]~~ it will work very near as long without polarization -

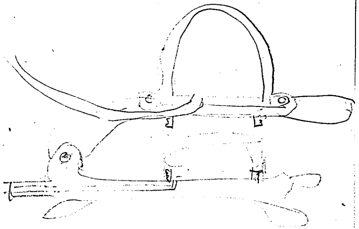
Sulphate Baryta — June 12 1892)

First Class - requires just 1 cell Daniell for polarization = ~~[illegible]~~ It is cut off 1st time ~~[illegible]~~ full loudness without cutting - & afterward ~~[illegible]~~ cut it off for 20 to 30 seconds 1 Daniell was too great polarizer because it was too weak & conductivity didn't give chance point polarize -

June 12 1877
TAE



~~Kc~~



June 15 1879 JOR

Final test of Chalk June 27, 1879.

Chloride Lithia - chalk
soft

Chalk - Ferrocyanide Potassium
good 1/2 loudness of Reg.
Clear = perhaps 2/3 loudness

Chalk Tartaric acid
just the slightest faint-
est sound

June 15 1879

Chalk . Sulphate of Zn.
irregular low. TAE

Chalk Acetate of aluminum
low

---

2 oz Chalk
$\frac{1}{4}$ oz caustic KO
Cannot see any differance between the regular Caustic NaO or KO, Loud and clear

---

Chalk Iodide of Potassium.
very low

Chalk Grape sugar
very very low

June 15 1879

Chalk permanganate of K
very very low.

Chalk Sulphate of Cu
very very low

Chalk Three drops Ferric Chloride
10 " Chloride of Calcium

very ~~very~~ low

Chalk Nitrate of Lime
pretty low

Chalk H_2O 15 drops of
Acetic acid

NG

Forms acetate of Ca

Chalk Bichromate of K 37
fair, not very loud;

Chalk H_2O ~~[illegible]~~ and 5
drops of Ferric Chloride
N. G.
June 15 1890 [illegible]

Chalk 1 ½ oz. and ½ oz
Neutral Phosphate of Soda
As good as regular —
solution saved

Chalk Nitrate of Zn
very very very low

Chalk Tartrate of Soda
very low

Chalk 1 oz Caustic Soda
20 drops Silicate of Soda

not as loud as regular
2/3 as loud June 15 1877 JA

Chalk common salt
extremely low

Chalk Phosphoric acid
very very low

Chalk very weak solution
caustic soda
low 1/4 loud regular

Chalk wet for 1 1/2 hours
laid out for 8 hours
4/5 of regular.

July 4 1879

Phosphate of Soda 1/4 oz saturated solution
Chalk 2 oz
moderately wet

$\frac{80}{200}$ .40 Daniells

.05 Daniells constant on line

June 13 1879 JAS

very wet .35 Daniells

.07 Daniells constant on line

not quite so loud as regular

Regular soaked 2 1/2 minutes
.4 Daniells 1/2 Oz caustic
.075 constant
very loud

July 4. new bug

Nothing on a baked regular, baked to red heat when Dry FAIR

Wet fair but irregular made the Chalk softer. scraping made it harder

---

Soft regular
Pretty fair

Old regular which was used in yesterday caustic potash will not soak in apparently too hard — Hard as glass outside soft inside.

Edison telephone July 7th 1879
5 AM. KaC
Chas Batchelor

At 2 pm July 4th Edison and Batchelor were experimenting on chalks and put away on shelf 2 chalks for test one was

No 1 2 oz chalk
$\frac{1}{4}$ fluid oz Caustic Soda
Hard pressed

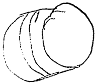
No 2 was 2 oz Chalk
$\frac{1}{4}$ oz Phosphate Soda

At this time they both tested alike

July 7th 1879 5 am
the No 1 was almost played out
the No 2 was very good not quite so loud as we have heard but loud enough for regular work

No 1 was wet
No 2 was put away again on shelf.

See page 49



Edison Telephone

TAE July 7 1879

Chas Batchelor 5 AM

2 oz Chalk
$\frac{1}{4}$ oz Caustic

worked good on July 4th
2 p.m.

Soaked 2 days in a 10 pc. Solution of Caustic Soda

Left out till now to dry.

July 7 5 AM Worked exceedingly loud and clear.

Testing here was with 340 tertiary

July 9th 1 AM 1879

$\frac{1}{4}$ loudness and uneven, much lower than No 2 Page 49

July 10th 4 AM

[illegible] or $\frac{1}{6}$ loudness

July 16. 2 am

Edison just hears it at diaph.

No efflorescence

from page 45

Chas Batchelor

No 1 by wetting came up to about
2/3 its original loudness.

~~[illegible]~~

July 9 1AM T A E

No 2 same as on 7th, this is
simply wonderful

put away again on shelf

No 1
same loudness as No 2

put away again on shelf

July 10 - 4 AM.
No 2 about 1/2 loudness of yesterday,
No 1 about 1/7 loudness have to
put your ear down but

→ 55

Edison telephone July 7 1879

5 A M

TA Chas Batchelor

2 chalks wet with $\frac{1}{4}$ Phosphate Soda were made on July 3 and have been out on the shelf ever since; when put in telephone worked well and ~~pretty~~ half loudness

1 left on Shelf after trying
the other was put on shelf to soak in solution of Phosphate Soda but crumbled down in the Solution

July 9 1879 1 a.m. The one left was fully talking good without any time being wet

Put on the Shelf again to wait

July 10 4 a.m.
Still talks good but pretty low

Edison's telephone July 7th 1879

[illegible] 5 AM
Chas Batchelor

Made a regular chalk July 3
at 2 p.m. and put it to soak
in 10 p.c. solution of Caustic Soda
with top out
at 5 AM July 7 it was tried and
worked half loudness

July 9 . 1 AM tried again
very low Edison can't hear
it at all unless he puts his
ear right down on the diaph.
then it is quite loud to him.

July 10 4 AM
about same

July 15th 2 AM from page 49

No 1 $\frac{1}{4}$ to $\frac{1}{5}$ loudness when he talks 3 inch away we can hear it a foot away Edison wiped the efflorescence from No 1 before using

TAE

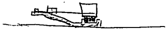
No 2 About $\frac{1}{6}$ loudness Edison hears it 2 inch away — No efflorescence

Inertia telephone was here put in and it did not work quite so well as our ordinary transmitter but when Edison now wet No 2 with water it worked a little better and afterward came out nice and loud

July 16 1879
2 AM

Chas Batchelor

Inertia telephone this telephone works excellent and does not require adjustment even when you shout in the diaphragm



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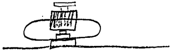
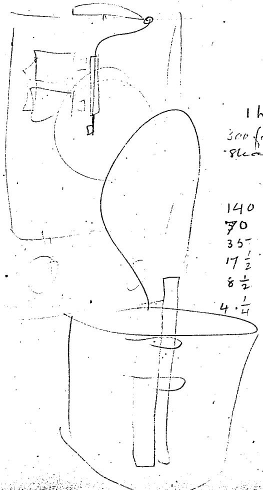


150
3000

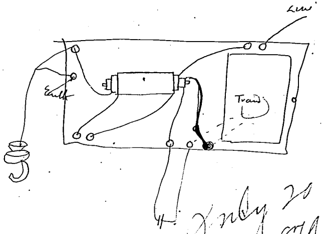
10,000
5
50,000

July 17 1879 TAE

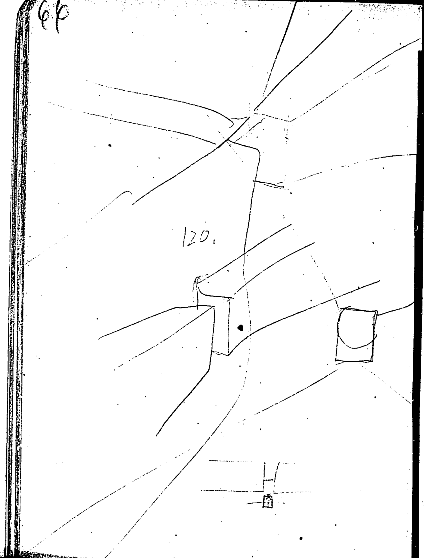


1 hp.
300 feet 1 inch
steam pipe

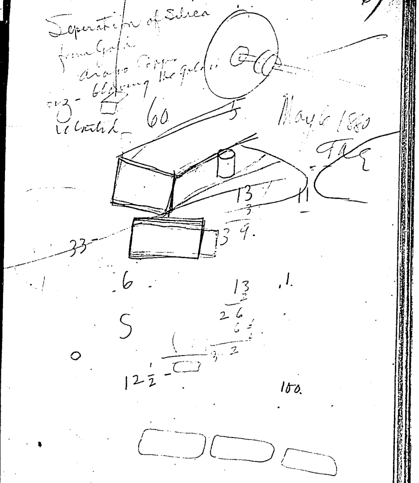
140	sqr	150
70		300
35		600
17 $\frac{1}{2}$		1200
8 $\frac{1}{2}$		2400
4 $\cdot\frac{1}{4}$		4800


Line
Earth
Trans

July 20
1879
TAE



Separation of Silica
from Gold
and also Copper
blowing the gold


3
crushed
60
5
11
13
3
39.
33
13
6
13
2
26
6
3.2
S
0
12 1/2
1.
100.

May 6 1880
TAE

266

190

124 266
67
1862
1596
144) 17822
342
288
542

6

30.19

36

5985

124

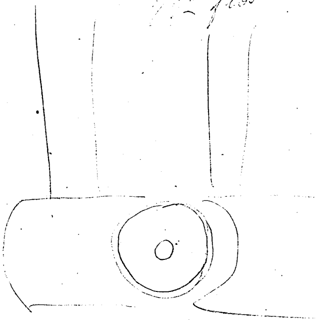
3628

326.52

228564
65304
88160
~~1111~~
12212
17632
8816
10.58 ~~92~~

1389
·81
1389
·81
~~10.58~~
~~1.48~~

88.



12519

H.U.

500 Gas jets 50 000 each
500 00
500
B heat 25,000,000

500 Elec jets 4200
500
2100000

42
500
21

25000000
2100000
22900000

.010616 3
500
0.5303.08000

18.44 18.44
500
00

18
500
9000
4

.44
500
220.00
2

94

1740
500
870000 134

1740 3 2

3 94.6

1740 2
500
3

94) 870000 (9255 30/94

2

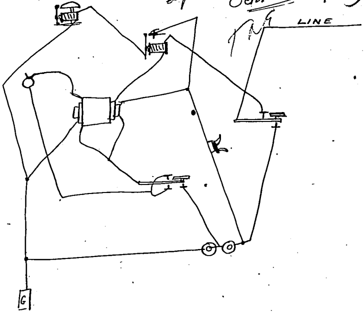
1740 : 94 ::

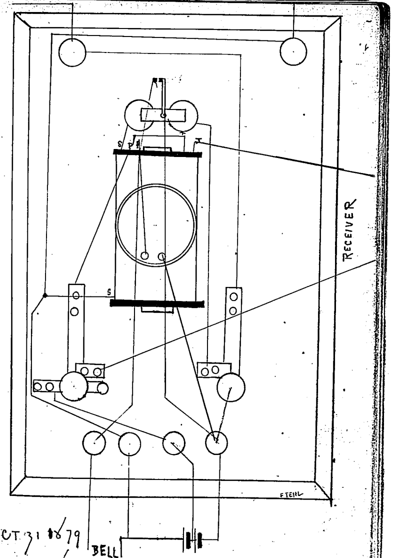
94 : 1740 :: 500 : X

94 : 1740 :: 500 : X

= 94 : 1740 :: 500 : 9255

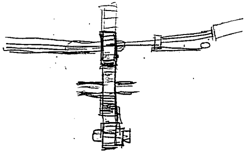
Telephone Connections
Oct 31st 1879




S
P
S
RECEIVER
BELL
F JEHL

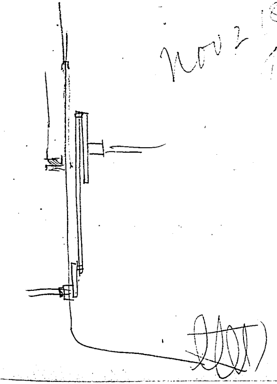
OCT 31 1879

TAE



Oct 31 1879

Nov 2 1879
TAE



755

2620

411

117 .334
330
.34

46

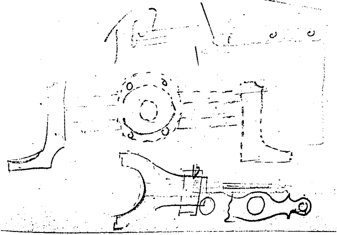
337

965
13
13
9.52

28.574
517
414
8
260

Dec 28th 79.
Machine No 2
Make Diameter of Iron wire 9.05
Diameter of fibre 9.28
JL.

Diameter of bare No 2 9.65
JL



25½

25.5 .12.45
6

.14.4. .42

1.8

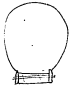
510
1020
144)70.710

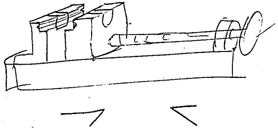
14) 25.5
115

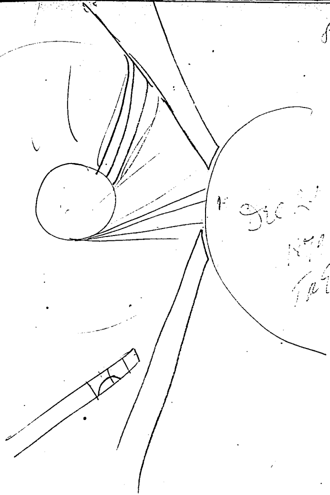
28.24

Dec 29

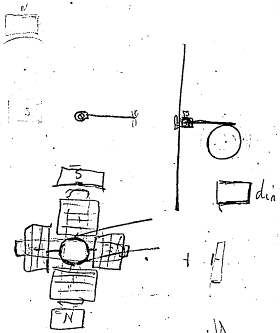
4 PM





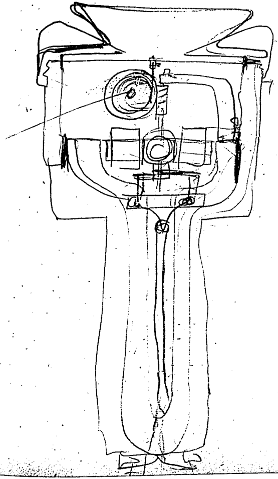


Dec 24
[illegible]
[illegible]



Dec 29. 1879
TAE

Dec 29 1879
TAE



Dec 29 1879
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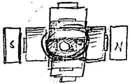
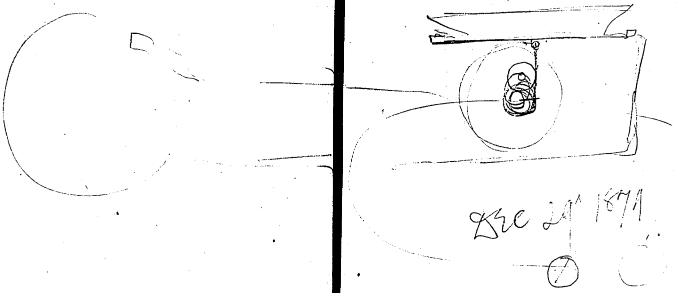
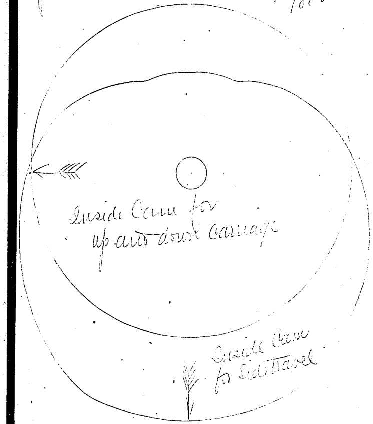


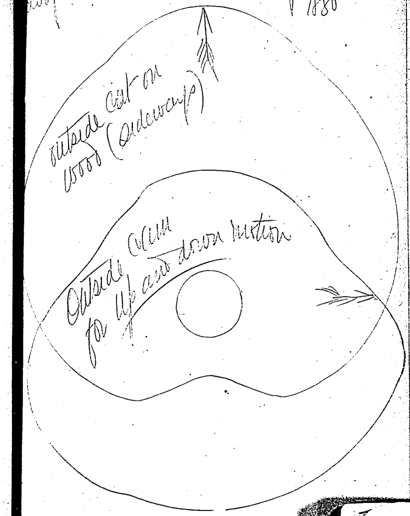


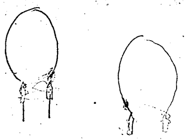
Dec 29 1879

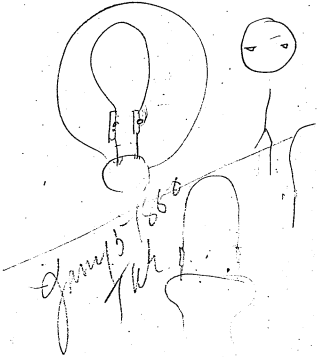
Loop making machine April 20th 1880


Inside Cam for up and down carriage
Inside Cam for Side travel

Loop making machine Apl 30 1880


outside cut on wood (sideways)
Outside cam for up and down motion





Jany 5 1880
TAE

Jany 5 1880
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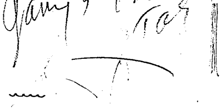
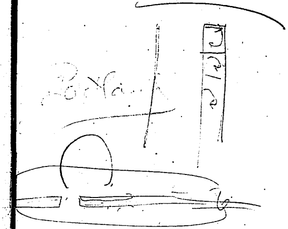




Portland

No 1 good

" 2 N.G

" 3 very good & Durable

" 4 a little better than old way

" 5 brass wire brush result in this position same as under No 3.

" 6 N.G brass brushes little sparks but very little current all. The work was thrown on the other machine

Expiriments

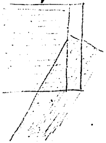
on Commutators Feb 8th 1880

J Kruesi

TRE

We found by turning the brush out at right angles X the commutator the spark disappeared which led to the following experiments

1



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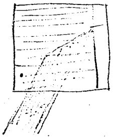

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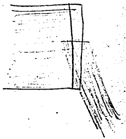

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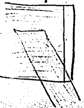
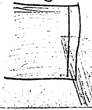
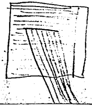


5



6



100

No 7 very wide [illegible] brushes
[illegible] all over the
commutator not
near as good as 3
& 5 wears off fast all work
thrown on other mach.

8 [illegible] brushes [illegible]
very good copper

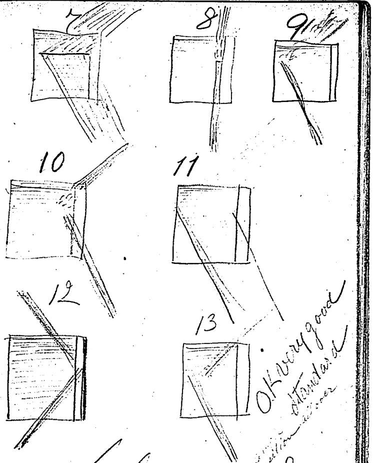
TM

narrow brush same 8
9 little sparks but no current
all thrown on [illegible] mach.

same brushes
10 Does more work [illegible] no
sparks on the other mach.
equaly as good than 3 & 5

11 ~~Same brushes as in 7 (wide)~~

12 same brushes as in 8.9 10 but.
contrary angle very good Does more
work than other mach without
sparking

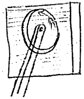


OK very good
Standard
[illegible]

TAE
Feby 8

[illegible] 390 [illegible]

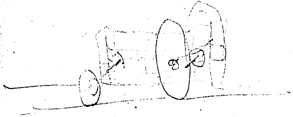
14



NG

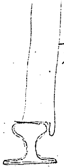
Feby 8 1880

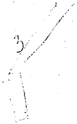
445
9
427.5

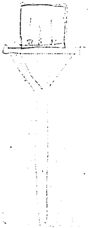


1

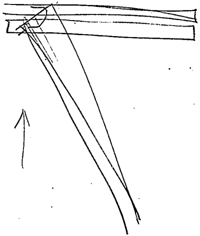
34
16
4 10

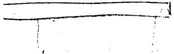




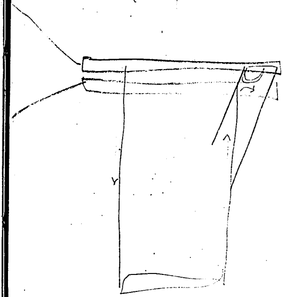


Feby 8 1880
TAE

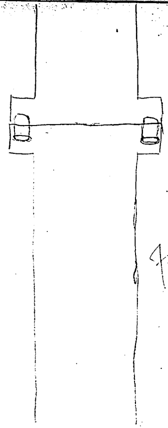




Feby 8 1880
TAE



104



Feby 8 1880
TAE

Feb. 10th 1880

107

Experimental Armature
with sheet Iron put on in a
spiral 80 ft of .034 iron

Very bad

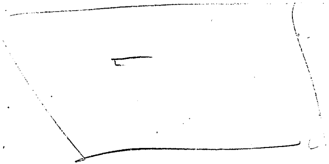
TAE

March 19th 1880

Dempeature at the start 19°
Number of Lamps on
machine No 6 = 75

65°

T M

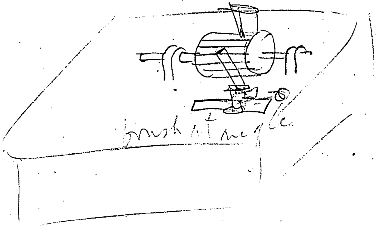


Take 8 oz. Troy of [illegible]
[illegible] must be crystalized
mix with 30 Cu. [illegible]
of Distilled water.

For [illegible] Chalk Take 1¾ oz &
2 Scruples

Sept 23d 1882

Model

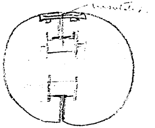


See page 99
this book

Feby 12 1880

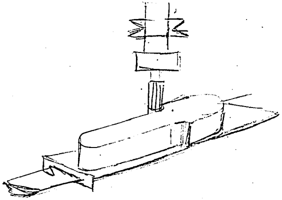
May 6 1880 TAE

Idea, little Electromotor carrier that
will run on a track in pipe track
being Composed of [illegible]



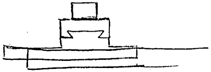
For messengers [illegible] to take place
of the telephone [illegible] [illegible].
The idea is to have [illegible]
[illegible] with [illegible]
to Customers 10 or [illegible] on
single line have [illegible]
put in a message [illegible] a
[illegible] [illegible] [illegible] out

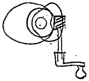
at the right Customer,

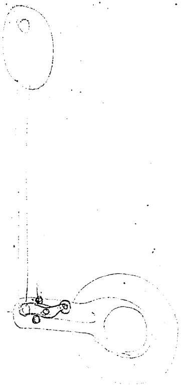


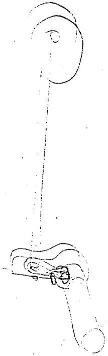
May 6 1880 TAE

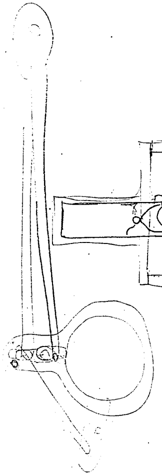
Porter can make us a pair of small Engines to work two magnetos, Each self contained, The current from one being used to energize all the field magnets on Central Station, the other is for a spare; We have a lever Connected with the Governor so that any required speed may be obtained of the Engine hence one can regulate the Elec on a [illegible] of the main circuit by Varying the speed of the Engine,

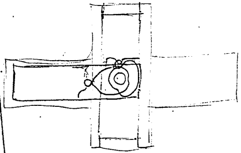


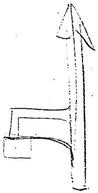


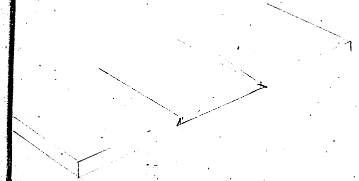




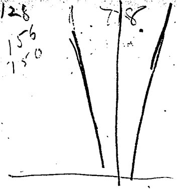






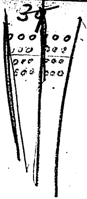


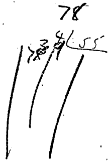
156
150



60)100(166
60
40
36

15)166(11
15
1





156

Feby 15. 1880

.15
20
3.00

Tag

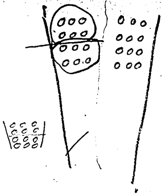
60

7)6(86
56
4

60 H.P.
8
.48

14

11)60
.5.5
.48
1 H.P 3

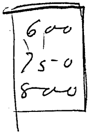


Jan. 2d 1880
Mr. Uptons calculation

4)56
.14 ohms

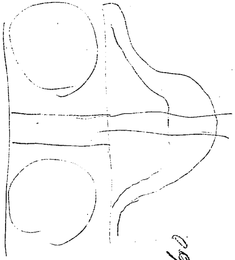
39 commutators
2
78 cuts
2
156
150

75 commutators

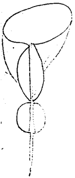


Feb/15 1880
TAE

600 120 Volts
1200 120 Volts

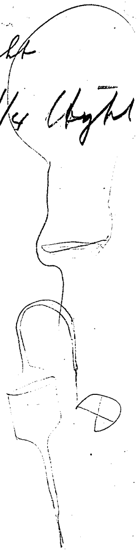


60



35 light

~~65~~ 1/4 Clight

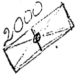


70 2

3 5
7
146

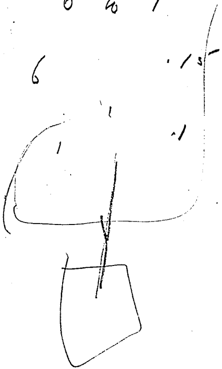
2000 200 2000000 200000

20



3. ohm

6 to 1



15

125 2200

250

2200

125 2

58 22000

125

11000

125

22

250 7

250

58)2750.0444~~4~~7620

232

430 67)47620

406

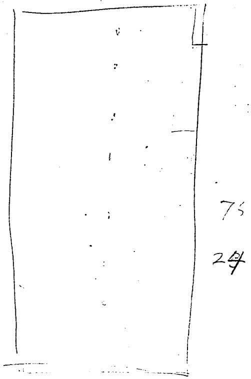
360

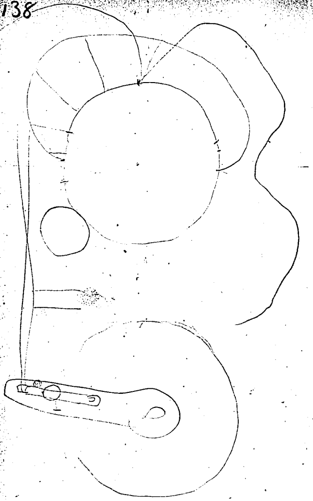
348

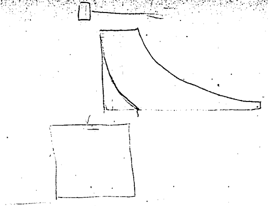
120

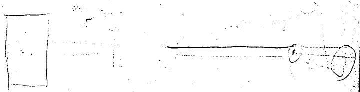
5

640

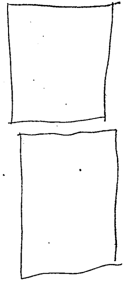


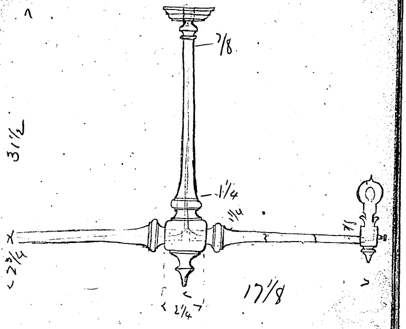






Feby 16 1880
TAE

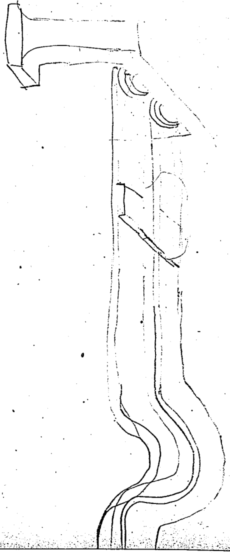


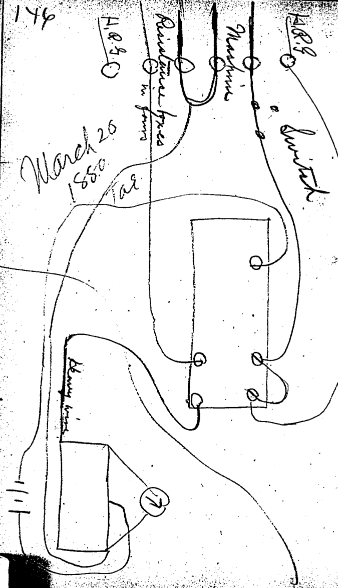

7/8
31½
1¼
¼
2¾
7½
2¼
17⅛

Feby 20 1880

TAE

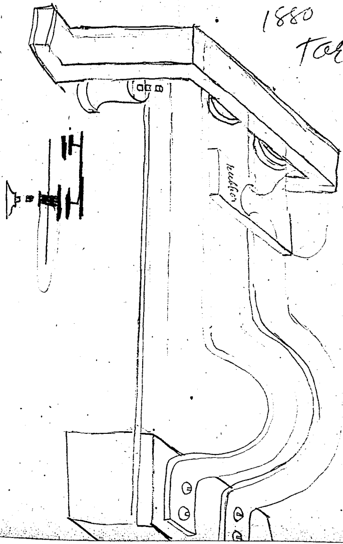
Circumference 10 ft 1/4"

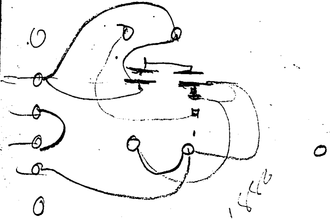



H.R.J.
Machine
Resistance boxes in frame
Switch
H.R.J.
Heavy wire

March 20
1880
TAE

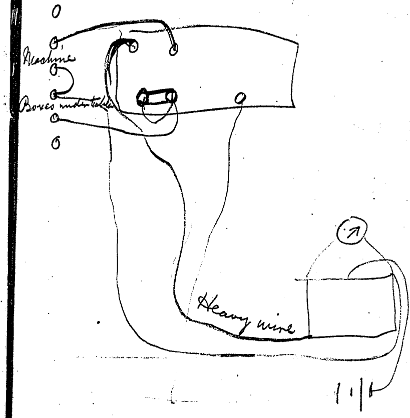
March 20
1880
TAE





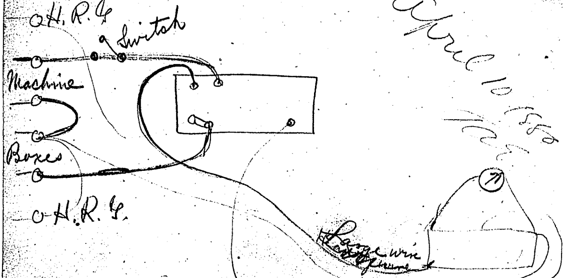
April 10 1880
TAE

April 10 1880
TAE

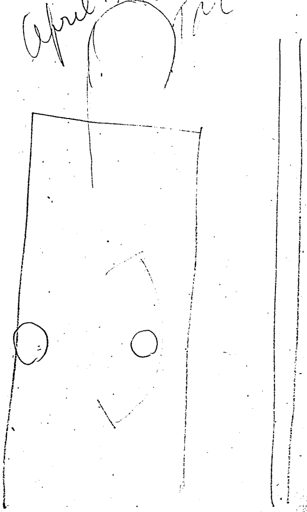

Machine
Boxes under table
Heavy wire

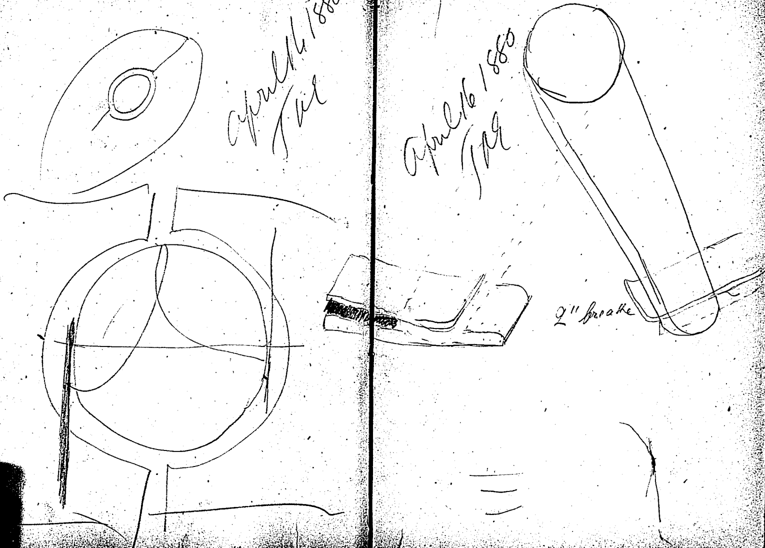
April 10 1880

TAE


H. R. G.
Switch
Machine
Boxes
H. R. G.
Large wire

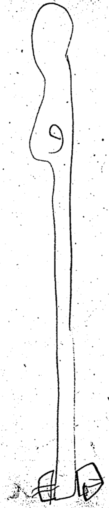
April 15 1880 TAE





April 16 1880
TAE

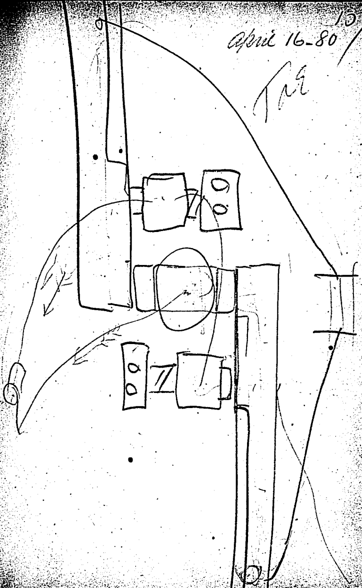
April 16 1880
TAE

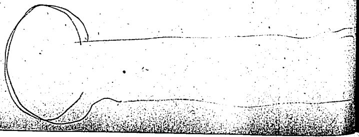


april 16 1880
TAE

april 16-80

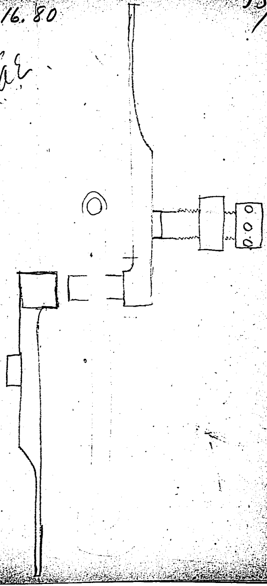
TAE



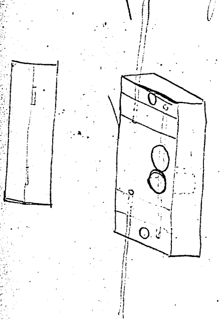


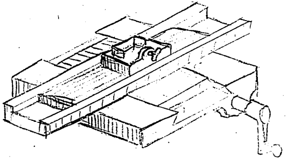
April 16. 80

Tar



April 16 1880
TAE





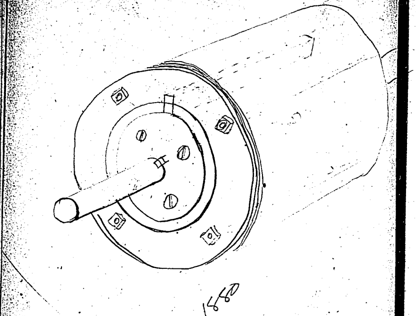
1000

112
9

12) 1008 = 84   1000
48   18
672
84   84
250) 1512   6
1500

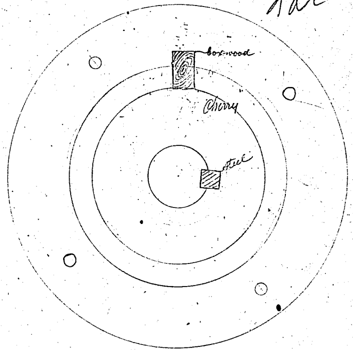
6	I
18	II
12	III
9	IIII

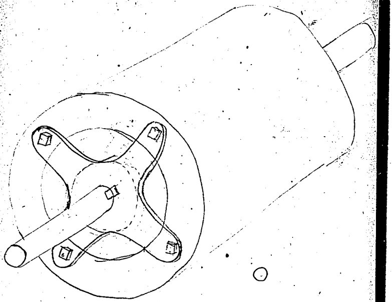
112



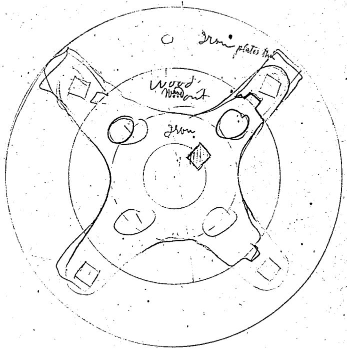
March 12 1880
TAE

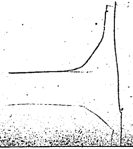
March 12th 1880
JK
TAE

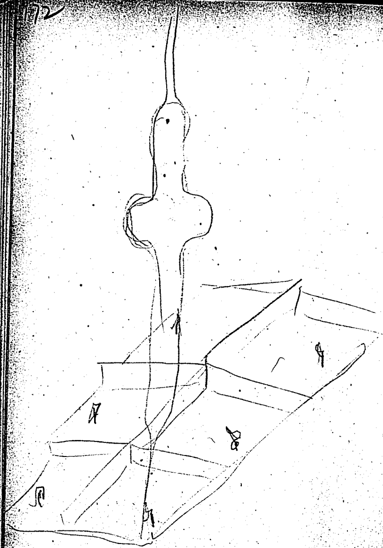

boxwood
cherry
steel

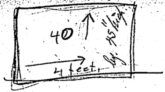


March 6th 1880
JK.

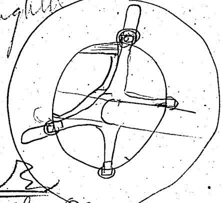

Iron plates thin
Wood
Wood out
Iron







Heighth same as in glass house



Repair Glass Blower
1. Man to blow in mould,
4 - heaters -
2 pullers - large
2 pullers small -
4 = Sealers for wire inside small
4 Sealers for large, ready for vac
2 to Blow in mould -
1 finisher after vac

Bench

. Loop cutting Machine, + place for man —
. Shelves for wood, unfinished + finished

1 Bench for finisher

Bench Saw for widening wood —

Bench Clamping machine —

~~glass~~

Bench Roll for rolling clamp wire flat

2 man Bench for man pulling on clamps up stairs

2 man = Pulling in Carbons up stairs.

1 — Inspecting bench large —

~~Rheostat~~ Etc Photometer,

Bench — man for putting plat wires to Copper — ~~[illegible]~~ — Quick running brush or gas.

Small	Large
300	2100
800	800
500	800
1600	1500
400	500
2000	2500
	8100
	2000
	6100

Bench Screw mac alongside, clamp machine —

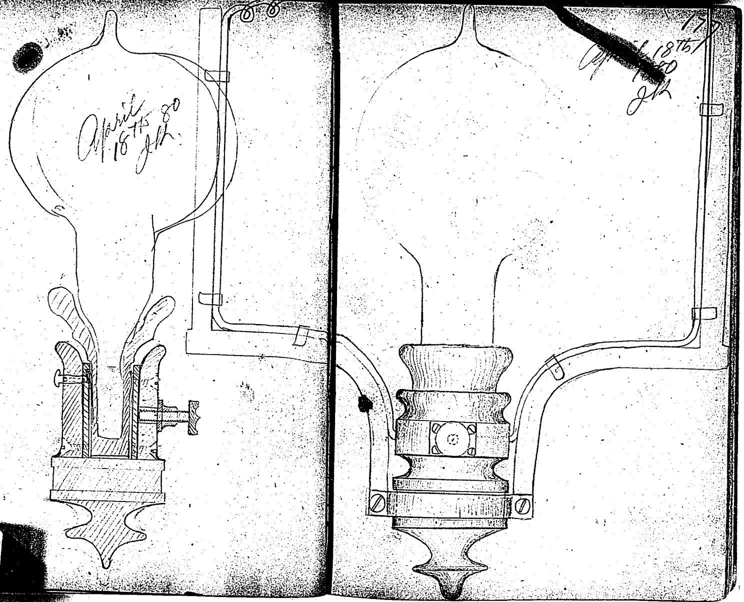
Repair man for pumps —

Carbon House —

Gashouse + Gasometer

Blower

Mercury Charg. House



April 18th 80
JL

April 18th 80
JL

May 20th 1880

(~~Track 1 Mile $2281.00~~) and For 1 Station

Track 10 Mile	22810.00
Station equipment & Side track.	4300.00
2 Trains 2 Engines 12 Cars	2440.00
	29,550.00

Operating Expenses

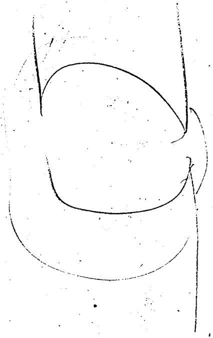
2 Ton of Coal per day —	$14
1 Man and Helper —	$ 5.00
Oil & Repair —	$ 2.50
	$ 21.50

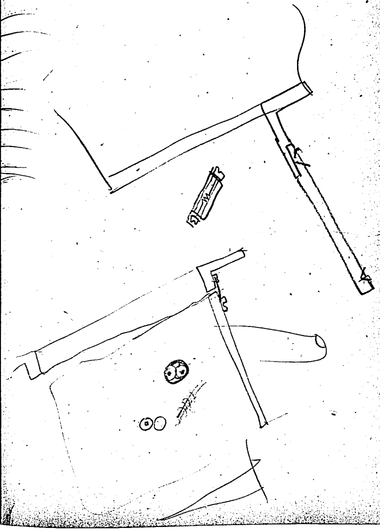
Average 30 trains a day
of 24 Tons each = 720 Tons.
$\frac{0.213}{1000}$ cents per Ton per Mile.

Ap. Cyl. — Part 17 — Page 332 — —

Metropolitan El. R. R of New York 1878
4 Cars in Train Weighing 40 tons — on gauge 4' 8½" —
curve 90 ft. radius (63° 40')

	Rigid Wheels	Loose Wheels
Traction on curve lbs.	1700	1300
" on straight line	600	450
Increased resistance per ton	27.50	21.25
Resistance per ton per degree	0.4319	0.3337.





120 Volts

21

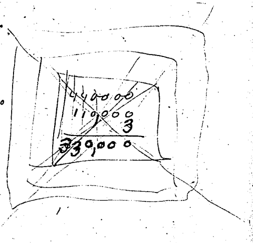
60
60

.14
.14

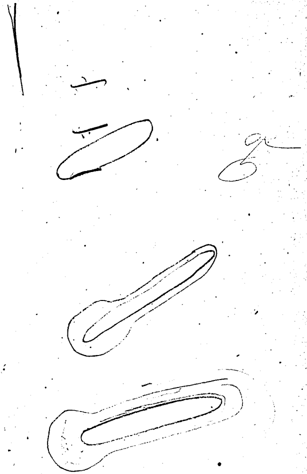
1/3 Ohm Total

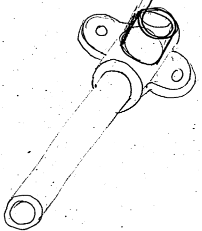
1/3 Ohm

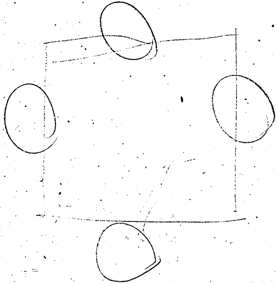
50
50
2500

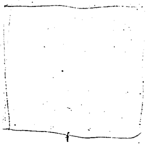


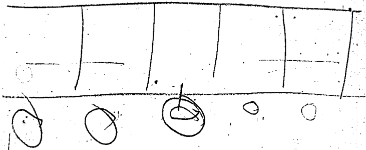
440000
110000
3
330,000

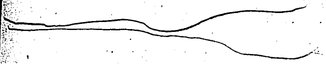


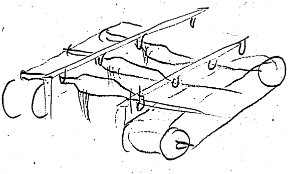


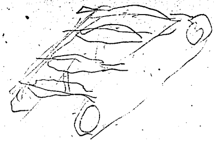


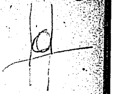


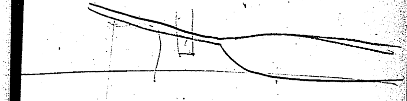


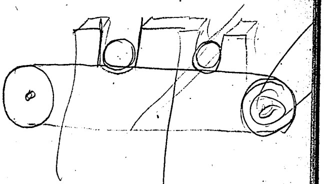


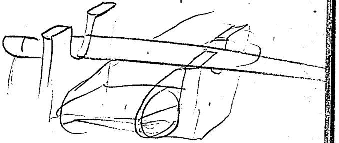


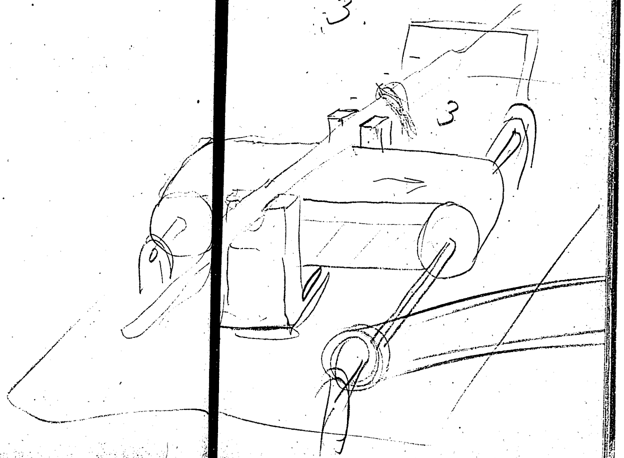











3
3

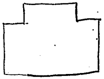
150 Tons in 10 hours = about
560 lbs. per min raised 24 ft. high. –
about ½ H.P. –
Bucket. 9 × 2¾ × 3¼ to hold 10#.
allow 60 buckets to empty per min.

Grainbucket 12" c. to c. 18" long 5½" deep 6½" wide
2'-6" diam. 22" face drum at bottom
4 ply 20" wide rubber belt. (6 bolts to each bucket)
3'-9" diam. 22" face drum at top.
Beltspeed 450 ft. per min.

~~4'-8" c. to c. of bucket. 30 revol.~~
~~give~~

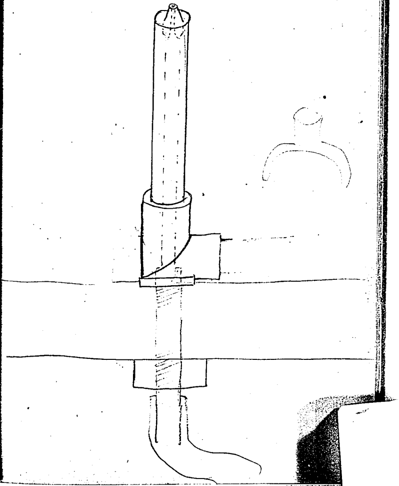
Frame of Magnetic Separator.

4 – 6" x 10" x 9'-6"
1 – 6" x 10" x 6'
5 – 3" x 3" x 22'-9" X
5 – 3" x 3" x 21' – X
2 – 3" x 3" x 14' – ✓
6 – 3" x 3" x 8' – ✓
12 – 3" x 3" x 4' –
2 – 3" x 3" x 5' –
2 – 3" x 3" x 6' –
2 – 3" x 3" x 7' – ✓
2 – 3" x 6" x 7'-6" ✓
3 – 3" x 6" x 4' –
2 – 2" x 8" x 12' –
1 – 2" x 8" x 8'-6" –
3 – 2" x 4" x 8'-6
2 – 2" x 4" x 12'
3 – 2" x 4" x 2'
13 – 2" x 4" x 5'-6"



Lumber
Gas house for Lamp factory

8. 3 × 4 7.' 8" long spruce

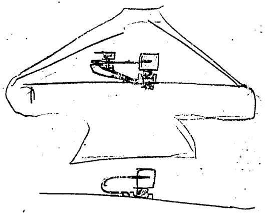


1000

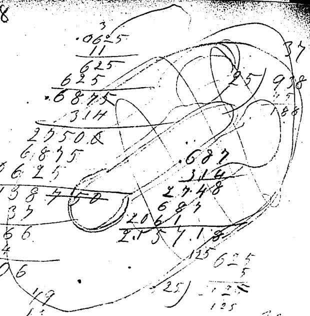
Telephone

July 13th /92

J Kruesi



3
.0625
11
625
625
.6875
3.14
27500
6875
20625
2.138~~750~~
37
14966
6414
79.106



37
25) 938
75
188

.687
314
2748
687
2061
2.15718

125
625
5
.125
25) 125
125

49
12
138

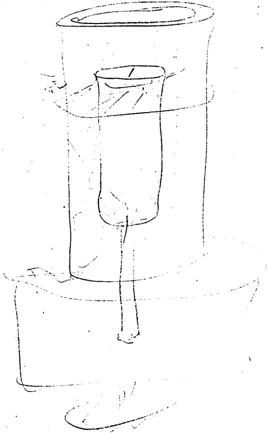
53.2 2.15
30
12) 64.50
45
90

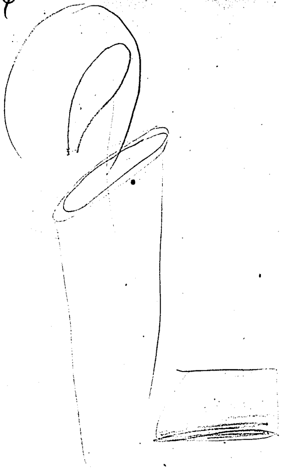
53.7
2
758) 1074 = 1.4
758
3160
3032
128

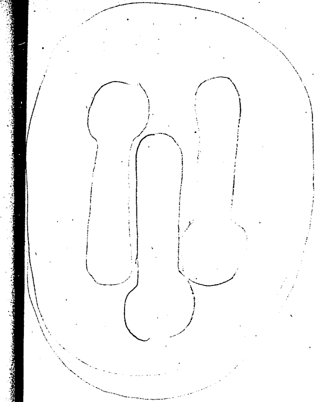
30
31) .938

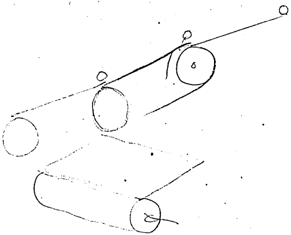
10 .625
5.
3) 3.125

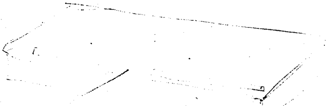
60) 1074

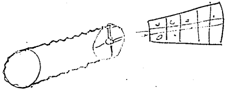


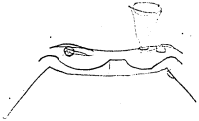


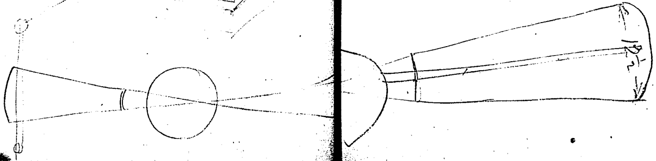








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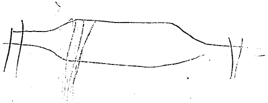

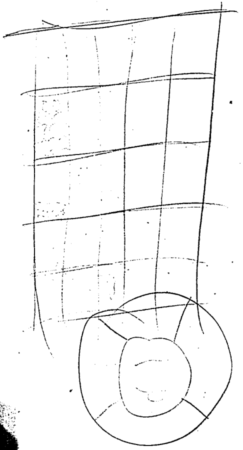

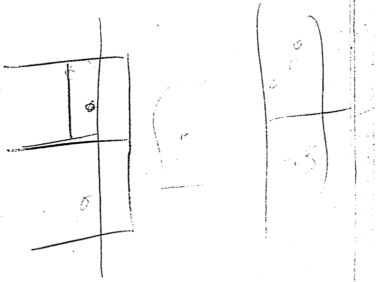

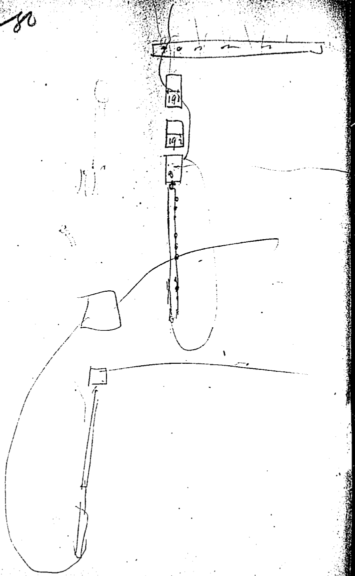
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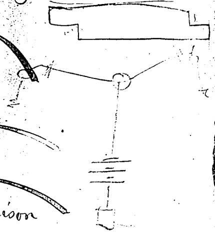
192

282

8/6/76 fx

4432



Thomas A Edison

John F. Randolph
Menlo Park
New Jersey

Thom